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09/622,736	10/27/2000	Mohammed Javed Absar	851663.413US	2744

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EXAMINER	
HAN, QI	
ART UNIT	**PAPER NUMBER**
2654	

DATE MAILED: 12/17/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/622,736	ABSAR ET AL.	
	Examiner	**Art Unit**	
	Qi Han	2654	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on 27 August 2004.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) 1-39 is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) 1-39 is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date 08/27/2004.

4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .

5) ☐ Notice of Informal Patent Application (PTO-152)

6) ☐ Other: _____.

DETAILED ACTION

1. The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

Information Disclosure Statement

2. The references listed in the Information Disclosure Statement submitted on 08/27/2004 have been considered by the examiner (see attached PTO-1449).

Response to Amendments

3. This communication is responsive to the applicant's amendment dated 08/23/2004. Applicant amended claims 1, 3, 6, 10 and 27 (see the amendment: pages 2-8 and 13).

4. Examiner withdraws the disclosure objections a-f, because applicant made correction(s) and/or amendment(s).

5. Examiner withdraws the claim objection regarding claim 27, because applicant made correction(s) and/or amendment(s).

6. Examiner withdraws the rejection of claims 1-2,4-5 and 7-8 under 35 USC 101, because applicant made correction(s) and/or amendment(s).

Response to Arguments

7. Applicant's arguments with respect to the independent claims 1-39 have been fully considered but are not persuasive.

In response to applicant's arguments regarding claims 1-9 and 17-23 that "the examiner point to no portion of Fielder suggesting that the claimed intermediate steps should be derived", "Nor does the establish that the steps are inherent", "the examiner fails to indicate how Fielder discloses or teaches: generating … as claimed" and "the examiner makes no attempt to identify what portion of Fielder teaches or suggests applying first post-multiplication factor…as claimed" (the amendment, page 18, paragraph 5 to page 20 paragraph 2), the examiner respectfully disagrees with applicant and has a different view of the prior art teachings and the claim interpretations. It is should pointed out that the argument says "the examiner concedes that Fielder does not disclose the claimed intermediate steps", which twists the examiner's words of "Fielder **does not expressly disclose all intermediate results or steps** in processing", which means some intermediate results or steps have been disclosed and some of them may be implicated by or derived from the disclosure (see the detail in the claim rejection in the office action). By reviewing the claim limitations, specification, and the rejection under 35USC 103 in previous office action, it is noted that the recited claim limitations are based on the mathematical reasoning steps disclosed in the specification, so that examiner's rejection follows the same manner and covers all the limitations as claimed (see detail in the rejection). Further, It is noted that the prior art starts with MDCT (equation 24) that is same as claimed, gives some intermediate processing steps or conditions (equations 25-27), and resulting an equivalent

expression (equation 28) (also see column 35, line 40 to column 36, lines 57), which can be derived to the claimed results by simple mathematical reasoning(s). It is also noted that mathematical equivalent expression can be interchangeable, and the intermediate steps or results either may be necessarily included or can be inherently derived, so that it is obvious to one skilled in the art to make the mathematical reasoning(s). For example, equation 28 can be simply derived to $C(k)= R(k)\cos(a+b) + Q(k)\sin(a+b) = R(k) [\cos(a)\cos(b) - (\sin(a)\sin(b)] - Q(k)[\sin(a)\cos(b)+\cos(a)\sin(b)] =\cos(b)[R(k) \cos(a) - Q(k) \sin(a)] - \sin(b)[R(k) \sin(a) + Q(k) \cos(a)]$, which is read on the claimed limitation.

In response to applicant's arguments regarding claims 10-13,16 and 24-27 that "examiner does not argue the intermediate step missing from Fielder are taught by Proakis, and points to no specific language in Proakis disclosing or suggesting the recited limitations", "both Fielder and Proakis teaches away from the claimed invention" (the amendment, page 20, paragraph 3 to page 21 paragraph 2), the examiner respectfully disagrees with applicant and has a different view of the prior art teachings and the claim interpretations. Regarding "the intermediate steps" issue, the response is based on the same reason as stated above. Regarding "a Fourier transform" issue (page 21, paragraph 2), it is noted that applicant only takes one embodiment as his argument base, but not argue the other portion the prior art disclosure referred by the examiner (see detail in the claim rejection). In addition, by reviewing the claim rejection in previous office action, Proakis teaches symmetry properties of the discrete-time Fourier transform (page 290-291) that disclose the mathematical relationships between different time domain/frequency domain signal components, including even/odd, real/ image, and conjugate relationship between input and output signals (page 190, equation 4.3.37, Fig. 4,29, page 415, equation 5.231, table 4.4 and table

5.1), and efficient computation of the DFT of two real sequences (page 475-476) that can compute two real signal sequences in a complex-valued sequence by performing a single DFT (FFT). Furthermore, it is noted that the reference of Proakis is a textbook, which teaches the general mathematic properties of the discrete-time Fourier transform for various signal processing application. Therefore, Therefore, it would have been obvious to one of ordinary skill in the art to apply or combine the teachings of the symmetry properties of the Fourier transform for various signal processing application, including audio signal processing as claimed, for the purpose of enhancing the efficiency of the FFT algorithm (Proakis: page 475, paragraph 6).

Regarding applicant's arguments regarding claims 14-15 and 28-29 (the amendment: page 21, paragraphs 3-4), the response is based on the same reason as stated above (also see detail in the claim rejections).

Therefore, as stated above, examiner believes that the rejection is proper and the applicant's arguments are not persuasive. In addition, there are some changes in the rejection of this office action, for reflecting the applicant's arguments and correcting miner errors, without changing the prior art teachings.

Claim Rejections - 35 USC § 103

8. Claims 1-9 and 17-23 are rejected under 35 U.S.C. 103(a) as being unpatentable over Fielder et al. (US 5,479,562) hereinafter referenced as Fielder.

As per **claim 1**, Fielder discloses a method and apparatus for encoding and decoding audio information (title), comprising:

i) multiplying the sequence of digital audio input samples with a first trigonometric function factor to generate an intermediate sample sequence (column 35, line 35 to column 36, line 8 and equation (26), 'premultiply step') ;

ii) computing a fast Fourier transform of the intermediate sample sequence to generate a Fourier transform coefficient sequence (column 36, lines 9-19 and equation (27));

iii) for each transform coefficient in the sequence, multiplying the real and imaginary components of the transform coefficient by respective second trigonometric function factors, adding the multiplied real and imaginary transform coefficient components to generate an addition stream coefficient, and subtracting the multiplied real and imaginary transform coefficient components to generate a subtraction stream coefficients (column 36, lines 20-35 and equation (28), 'a postmultiply step', wherein equation (28) has equivalent function and same result as the equation 16 in the specification, for example applying trigonometric equation cos(a+b)=cos(a)cos(b)-sin(a)sin(be) and sin(a+b)=sin(a)cos(b)+cos(a)sin(b) to equation (2), which produces an equivalent expression and is read on the claimed limitation);

iv) multiplying the addition and subtraction stream coefficients with respective third trigonometric function factors (column 36, lines 20-35 and equation (28), 'a postmultiply step', wherein equation (28) has equivalent function and same result as the equation 16 in the specification, which reads on the claimed limitation); and

v) subtracting the corresponding multiplied addition and subtraction stream coefficients to generate audio coded frequency domain coefficients (column 36, lines 20-35 and equation (28), 'a postmultiply step', wherein equation (28) has equivalent function and same result as the equation 16 in the specification, for example applying trigonometric equation cos(a+b) =

cos(a)cos(b)-sin(a)sin(be) and sin(a+b)=sin(a)cos(b)+cos(a)sin(b) to equation (2), which produces an equivalent expression and is read on the claimed limitation which reads on the claimed limitation);

Even though Fielder discloses some the intermediate results or steps, Fielder dos not expressly disclose every intermediate result or step in the processing. However, those intermediate results or steps of the processing are obvious to one skilled in the art to be obtained through a simple mathematical reasoning, because Fielder teaches a starting equitation (24), condition equations (6 and 25), intermediate equations (26, 27 and some part of 28), and final result equation (28), which correspond to Eq.1, Eq. 13 and Eq. 16 of the specification and can derive or inherently include other intermediate steps of using trigonometric functions, multiplying addition and subtraction processes as claimed. For example, equation 28 can be simply derived to C(k)= R(k)cos (a+b) + Q(k)sin(a+b) = R(k) [cos (a)cos (b) - (sin(a)sin(b)] – Q(k)[sin(a)cos(b)+cos(a)sin(b)] =cos(b)[R(k) cos(a) - Q(k) sin(a)] – sin(b)[R(k) sin (a) + Q(k) cos(a)], which equivalent to the claimed limitation. Therefore, it would have been obvious to one of ordinary skill in the art at time the invention was made to compute Fielder' the equations by a simple mathematical reasoning, for the purpose of providing a complete computation algorithm to reach the final conclusion (equation 28) from a staring point (equation 24) (Fielder: column 35, lines 60-67).

As per **claim 2** (depending on claim 1), Fielder further discloses the audio coded frequency domain coefficients comprise modified discrete cosine transform coefficients (column 35, lines 33-59).

As per **claim 3** (depending on claim 1), Fielder further discloses that the first trigonometric function factor for each audio sample is a function of the audio sample sequence position (n) and the number (N) of samples in the sequence (column 36, eq. (26)).

As per **claim 4** (depending on claim 1), Fielder further discloses that the respective second trigonometric function factors for each transform coefficient in the sequence are respective functions of the transform coefficient sequence position (k) and the number (N) of coefficients in the sequence (column 36, eq. (28)).

As per **claim 5** (depending on claim 1), Fielder further discloses that the respective third trigonometric function factors are respective functions of the transform coefficient sequence position (k) (column 36, eq. (28) and column 18 eq. (6), angle of 2pi (k+ ½) m/N = 2pi (k+ ½)/4 + pi (k+ ½), where m=(N/2 +1)/2, so that a trigonometric function factor of sum of two angles can be expressed by a sum (two terms) of trigonometric function factors with individual angles, i.e. cos(a+b) = cos (a) cos(b) - sin(a)sin(b), therefore one of the trigonometric function factors can be read on the claimed limitation).

As per **claim 6** (depending on claim 1), Fielder does not expressly disclose that the step i) comprises multiplying the input sequence samples x[n] by the first trigonometric function factor $\cos(\pi n/N)$ to generate the intermediate sample sequence, where: x[n] are the input sequence audio samples; N is the number of input sequence audio samples. However, Fielder discloses multiplying the input sequence samples x[n] by $\cos(-\pi n/N)$ (column 36, eqs. (26) and (27), where $\exp(-j\ \pi n/N) = \cos(-\pi n/N) + j \sin(-\pi n/N)$), which is symmetric to eq. 11 in the specification (page 10) and also corresponds to eq. 13 (specification: page 11), which suggests that computing intermediate result in eq. 13 by using factor $\exp(-j\ \pi n/N)$ has equivalent

functionality of computing intermediate result in eq. 12, since there is a conjugation relationship between them). Therefore, it would have been obvious to one of ordinary skill in the art at time the invention was made to modify Fielder by providing multiplying the input sequence samples x[n] by an exchangeable a factor, either exp(j πn/N) or exp(-j πn/N), for the purpose of providing an alternative computation for the process.

As per **claim 7** (depending on claim 1), Fielder further discloses that step ii) comprises computing the fast Fourier transform of the intermediate sample sequence so as to generate said transform coefficient sequence Gk = gk,r + jgk,i, where: Gk is the transform coefficient sequence; gk,r are the real transform coefficient components; gk,i are the imaginary transform coefficient components; and k=O (N/2 - 1), (column 36, eqs. (27) and (28), where X*(k), R(k) and Q(k) correspond to Gk, gk,r and gk,i, respectively).

As per **claim 8** (depending on claim 1), Fielder does not expressly disclose that step iii) comprises determining the addition stream coefficients T2 and subtraction stream coefficients T, according to: T1 = gk,r cos (pi(k + 1/2)/N) - gk,i sin (pi(k + 1/2)/N); T2 =gk,r cos(pi(k+1/2)/N) + gk,i sin (pi(k+1/2)/N); where T1 and T2 are the subtraction stream and addition stream coefficients, respectively. However, Fielder discloses, as stated above (see claim 1), a starting equitation (24) with condition equations (6 and 25) that corresponds to eq.1 of the specification, intermediate equations (26, 27) that corresponds to intermediate eq. 13 of the specification, and final result equation (28) that corresponds to eq. 16 of the specification, in which the claimed limitation can be proven or derived from the referenced prior art equations through a mathematical reasoning, which also means that the equation 28 can be reasoned to derive the claimed terms. Further, according to eq. (28) (column 36) and eq. (6) (column 18), the angle in

eq. (28) can be separated into to two angles: 2pi (k+ ½) m/N = 2pi (k+ ½)/4 + pi (k+ ½), where m=(N/2 +1)/2, so that the trigonometric function factor of sum of two angles can be expressed by a sum (two term) of trigonometric function factors of individual angles, such as cos(a+b) = cos (a) cos(b) + sin(a)sin(b), thus one of the trigonometric function factors can read on the claimed limitation. Therefore, it would have been obvious to one of ordinary skill in the art at time the invention was made to compute Fielder's equations by mathematical computing or reasoning, including intermediate steps and result as claimed, for the purpose of providing a complete computation algorithm from a staring point (equation 24) to reach the final conclusion (equation 28) (Fielder: column 35, lines 60-67).

As per **claim 9** (depending on claim 1), Fielder does not expressly disclose that steps iv) and v) comprise generating the audio coded frequency domain coefficients Xk according to: Xk = T1 cos (pi(2k+1)/4) - T2 sin (pi(2k+1)/4); where Xk are the audio coded frequency domain coefficients; and cos (pi(2k+1)/4) and sin (pi(2k+1)/4 are the third trigonometric function factors. However, Fielder discloses, as stated above (see claim 1), a starting equitation (24) with condition equations (6 and 25) that corresponds to eq.1 of the specification, intermediate equations (26, 27) that corresponds to intermediate eq. 13 of the specification, and final result equation (28) (see column 35, line 33 to column 36, line 35) that corresponds to eq. 16 of the specification, in which the claimed limitation can be proven or derived from the referenced prior art equations through a mathematical reasoning, which suggests that the equation can be reasoned to derive the claimed terms. Further, according to eq. (28) (column 36) and eq. (6) (column 18), the angle in the eq. (28) can be separated into to two angles: 2pi (k+ ½) m/N = 2pi (k+ ½)/4 + pi (k+ ½)/N, where m=(N/2 +1)/2, so that the trigonometric function factor with a

sum of two angles can be expressed by a sum (two term) of trigonometric function factors with individual angles, such as cos(a+b) = cos (a) cos(b) + sin(a)sin(b), thus, one of the trigonometric function factors can read on the claimed limitation. Therefore, it would have been obvious to one of ordinary skill in the art at time the invention was made to compute Fielder' the equations by a mathematical reasoning, including intermediate steps and result as claimed, for the purpose of providing a complete computation algorithm from a staring point (equation 24) to reach the final conclusion (equation 28) (Fielder: column 35, lines 60-67).

As per **claim 17**, the rejection is based on the same reason described for claim 1, because claim 17 recites same or similar limitation(s) as claim 1.

As per **claim 18** (depending on claim 17), Fielder further discloses that the pre-multiplication factor, and first and second post-multiplication factors are trigonometric function factors (column 36, equations (26) and (28), wherein factor exp(-j πn/N) = cos(- πn/N) + j sin (-πn/N), and term of cos [2pi (k+ ½) m/N] = cos [2pi (k+ ½)/4 + pi (k+ ½)] when using equation 16: m=(N/2 +1)/2; so that by further using a trigonometric property of cos(a+b) = cos (a) cos(b) - sin(a)sin(b), the term of cos() or sin() in equation 28 produces two trigonometric function factors, which reads on the claimed limitation).

As per **claims 19-21** (depending on claim 17), the rejection is based on the same reason described for claims 3-5 respectively, because claims 19-21 recites same or similar limitation(s) as claims 3-5 respectively.

As per **claim 22** (depending on claim 17), Fielder further discloses that the pre-processing operations are performed on each sample in the input sequence individually (column

36, equation 27, which shows that the operation is performed on each sample in input x(n) individually).

As per **claim 23** (depending on claim 17), Fielder further discloses that the post-processing operations are performed on each transform coefficient in the sequence individually, (column 36, equation 28, which shows that the post-processing operation is performed on each transform coefficient R(k) and Q(k) individually).

9. Claims 10-13, 16 and 24-27 are rejected under 35 U.S.C. 103(a) as being unpatentable over Fielder in view of Proakis et al. ("Digital Signal Processing, principles, algorithms, and applications", 3rd Edition, 1996, ISBN 0-13-373762-4) hereinafter referenced as Proakis.

As per **claim 10**, Fielder discloses a method and apparatus for encoding and decoding audio information, comprising:

combining first and second sequences of digital audio samples from first and second audio channels into a single complex sample sequence (column 16, line 40 to column 17, line 11 'a single FFT can be used to perform the DCT and DST simultaneously by defining them respectively as the real and imaginary components of a signal complex transform' and 'processing a signal sample block from each of the two channels', which suggest that the signal uses the real component for one channel and imaginary components for another channel);

determining a Fourier transform coefficient sequence (column 16, lines 40-55, 'a single FFT can be used to perform the DCT and DST simultaneously by define them respectively as the real and imaginary components of a signal complex transform'; column 36, lines 9-35 and

equations 27 and 28, where in the signal x(n) has real and imaginary components: x(n)=xr(n)+jxi(n));

for each of the first and second transform coefficient sequences, generating audio coded frequency domain coefficients to generate respective sequences of said audio coded frequency domain coefficients for the first and second audio channels (column 16, lines 40-55, 'a single FFT can be used to perform the DCT and DST simultaneously by define them respectively as the real and imaginary components of a signal complex transform'; column 36, lines 20-55 and equation 28, 'In two-channel systems, signal sample blocks from each of two channels are transformed by FFT processes into DCT1/DCT2 block pair').

Even though, as stated above, Fielder discloses that a single FFT can be used to perform the DCT and DST simultaneously by defining them respectively as the real and imaginary components of a single complex transform (column 16, lines 40-55), and further discloses some the intermediate results or steps of processing transform coefficient sequences (equations 6, 24, 26, 27 and 28 and column 35, line 32 to column 36, lines 67), Fielder does not expressly disclose all detailed intermediate steps for "generating first and second transform coefficient sequences by combining and/or differencing first and second selected transform coefficients from said Fourier transform coefficient sequence". However, this feature is well known in the art as evidenced by Proakis, who teaches symmetry properties of the discrete-time Fourier transform (page 290-291) that disclose the mathematical relationships between different time domain/frequency domain signal components, including even/odd, real/image, and conjugate relations (equations 4.3.37 and 5.2.31, Tables 4.4 and 5.1, and Fig. 4.29), specially combining the third and fourth properties in Tables 4.4 and 5.1, which corresponds the claimed limitation.

Fielder further discloses an efficient computation of the DFT of two real sequences (page 475-476) that can compute two real signal sequences in a complex-valued sequence by performing a single DFT (FFT), so that the respective sequences of audio frequency domain coefficient sequences for the two real signal sequences (corresponding to two audio channel signals) can be derived by using the FFT transformed coefficients and the symmetry properties. Therefore, it would have been obvious to one of ordinary skill in the art at time the invention was made to modify Fielder by specifically providing a FFT algorithm to perform a single DFT for two real signal (two channel) sequences by using the symmetry properties of the Fourier transform, as taught by Proakis, for the purpose of enhancing the efficiency of the FFT algorithm (Proakis: page 475, paragraph 6).

As per **claim 11** (depending on claim 10), Fielder in view of Proakis further discloses that for each corresponding coefficient in the first and second transform coefficient sequences, selecting first and second transform coefficients from said Fourier transform coefficient sequence, determining a complex conjugate of said second transform coefficient, combining said first transform coefficient and said complex conjugate for said first transform coefficient sequence and differencing said first transform coefficient and said complex conjugate for said second transform coefficient sequence, (Fielder: column 36, lines 35 and equations 27, 28 and 6; Proakis: pages 290-291, equation 4.3.37 and Table 4.4, wherein two time domain signal sequences can be defined as a complex sequence: x(n) = xr(n) + jxi(n); the frequency domain sequence can be expressed by: X(k)=FFT[xr(n)exp(-jnpi/N)+jxi(n)exp(-jnpi/N)] = Xr(k)+jXi(k), which corresponds to equation 27 of Fielder; and the frequency domain sequence can be further expressed by: X(k)= Xr(k)+jXi(k) = [Xre(k)+jXio(k)] + [Xro(k)+jXie(k)] = Xxr(k) +Xxi(k),

wherein the subscripts indicate: r -- real part, i –imaginary part, e – even part, o – odd part, x – corresponding input signal sequences, which corresponds to term R(k) and Q(k) in equation 28 of Fielder by combining symmetry properties on equation 4.4.37 (Proakis: page 290) and complex conjugate process in Table 5.1 (Proakis: page 415), wherein equation 28 of Fielder has same form but the R(k) and Q(k) include both components from the first and second signals xr and xi, and using third and fourth properties in Table 4.4 or 5.1, two audio signal frequency sequences can be obtained).

As per **claim 12** (depending on claim 10), the rejection is based on the same reason described for claim 6, because claim 12 recites same or similar limitation(s) as claim 6.

As per **claim 13** (depending on claim 11), Fielder in view of Proakis further discloses a properties of DTFT: Xe(k)=1/2[X(k)+X*(N-k)] and Xo(k)=1/2[X(k)-X*(N-k)] (Proakis: page 415, Table 5.1) and the derived equations for computation of the DFT of two real sequences (Proakis: page 476, equations 6.2.7 and 6.2.8), where e indicates even part, o indicates odd part, and X(k) corresponds to coefficient X*(k) in equation 27 of Fielder (Fielder: column 36, lines 1-35), so that the combined teachings correspond to the clamed "said first and second transform coefficient sequences are generated according to: Gk (Zk + Z*N-k-1)/2, G'k (Zk - Z*N-k-1)/2j where Gk is said first transform coefficient sequence; G'k is said second transform coefficient sequence; N is the number of input sequence audio samples; k = 0,…, (N/2 - 1); Zk is said first transform coefficient; Z*N-k-1 is the complex conjugate of said second transform coefficient; and j is the complex constant".

As per **claim 16** (depending on claim 10), Fielder in view of Proakis further discloses

applying a windowing function in combination with multiplying the complex sample sequence by a first trigonometric function factor (Fig. 1a, 'analysis widow'; Figs. 6a-6d).

As per **claim 24**, it recites audio coding method, which corresponds to the combination of claims 1, 10 and 13. The rejection is based on the same reason described for claims 1,10 and 13, because claim 24 recites same or similar limitation(s) as claims 1,10 and 13.

As per **claims 25** (depending on claim 24), the rejection is based on the same reason described for claim 3, because claim 25 recites same or similar limitation(s) as claim 3.

As per **claims 26** (depending on claim 24), the rejection is based on the same reason described for claim 18, because claim 26 recites same or similar limitation(s) as claim 18.

As per **claim 27**, Fielder discloses a method and apparatus for encoding and decoding audio information, comprising:

obtaining first and second input sequences of digital audio samples x[n], y[n] corresponding to respective first and second audio channels, (column 16, line 40 to column 17, line 11, 'both input signal sample blocks consist only real-valued samples' and 'processing a signal sample block from each of the two channels');

combining the first and second input sequences of digital audio samples into a single complex input sample sequence z[n], where z[n] = x[n] + jy[n], (column 16, lines 43-64; 'a single FFT can be used to perform the DCT and DST simultaneously by define them respectively as the real and imaginary components of a signal complex transform', which suggest that the input signals includes a real component for one channel and an imaginary components for another channel);

pre-processing the complex input sequence samples including applying a pre-multiplication factor cos(pi n/N) +jsin(pi n/N) to obtain modified complex input sequence samples, where N is the number of audio samples in each of the first and second input sequences and n = 0,..., (N-1) (column 36, equations (26) and (27), wherein a factor of exp(-j πn/N) = cos(- πn/N) + j sin (- πn/N) is used for pre-multiplying, which has equivalent functionality of the claimed limitation because one of intermediate results can be derived from the other by conjugate processing (based on eqs. 12 and 13 of the specification));

transforming the modified complex input sequence samples into a complex transform coefficient sequence Zk utilizing a fast Fourier transform, wherein k = 0,..., (N/2- 1), (column 16, lines 40-55, 'a single FFT can be used to perform the DCT and DST simultaneously by define them respectively as the real and imaginary components of a signal complex transform'; column 36, lines 9-35 and equations 27, 'signal sample blocks from the two channels are transformed by FFT processes into DCT1/DCT2 block pair', wherein input sequence x(n) may have two sequences combined in a complex sequence, so that in this case it is obvious that equation 27 would be: X*(k)= FFT[xr(n)exp(-jnpi/N) + jxi(n)exp(-jnpi/N)]; and

post-processing the sequence of complex transform coefficients to obtain first and second sequences of audio coded frequency domain coefficients (column 36, lines 9-35 and equations 28).

But, Fielder does not expressly disclose "to obtain first and second sequences of audio coded frequency domain coefficients corresponding to the first and second audio channels Xk, Yk" according to claimed intermediate steps of computing the process for a two-channel system using complex signal in an FFT transform. However, this feature is well known in the art as

evidenced by Proakis, who teaches symmetry properties of the discrete-time Fourier transform (page 290-291) that disclose the mathematical relationships between different time domain/frequency domain signal components, and efficient computation of the DFT of two real sequences (page 475-476) that combines the two real signal sequences, such as two channel signal sequences, into a complex-valued sequence for performing a single DFT (FFT), so that the respective sequences of audio frequency domain coefficient sequences for the two real signal sequences (corresponding to two audio channel signals) can be derived by using the FFT transformed coefficients and the symmetry properties. Particularly, Proakis discloses equations 6.2.7 and 6.2.8 (page 476) that are equivalent to the claimed Gk and G'k, and symmetry equation 5.2.31 (page 415), which can be used in equation 28 of Fielder to generate the claimed result by mathematically reasoning: let a=2pi(k+1/2)/4, b=pi(k+1/2)/N, Xr=R(k), Xi= -Q(k), X(k)=(X*(k))*=[R(k)-jQ(k)]= Xr+jXi (Fielder: eq. 27); and take m=(1+N/2)/2 (Fielder: eq.16), then from eq.28 (Fielder):

C(k)= R(k)cos (a+b) + Q(k)sin(a+b) = Xr cos (a+b) - Xi sin(a+b)

= Xr [cos (a)cos (b) - (sin(a)sin(b)] - Xi[sin(a)cos(b)+cos(a)sin(b)]

=cos(b)[Xr cos(a) - Xi sin(a)] – sin(b)[Xr sin (a) + Xi cos(a)]

= cos(b)[(Xre+Xro)cos(a)–(Xie+Xio)sin(a)] – sin(b)[(Xre+Xro)sin(a)+(Xie+Xio)cos(a)]

where, subscripts indicate: r—real part, i—imaginary part, e—even part, o—odd part, since Proakis teaches that even part of frequency coefficient: X1(k) = [X(k)+(X*(N-k)]/2=Xre+jXie corresponds to real part of input sequence x1(n) and odd part of frequency coefficient X2(k)=[X(k)+(X*(N-k)]/j2=Xro+jXio corresponds to imaginary part of input sequence x2(n) (Proakis: page 415, Table 5.1 and equation 5.2.31; page 476, equations 6.2.7 and 6.2.8), thus,

separating the even and odd parts into two groups would lead to obtain the respective frequency coefficients corresponding to the two input signal sequences as claimed.

Therefore, it would have been obvious to one of ordinary skill in the art at time the invention was made to modify Fielder by specifically providing a FFT algorithm by performing a single DFT for two real signal (two channel) sequences by using the symmetry properties of the Fourier transform, as taught by Proakis, for the purpose of enhancing the efficiency of the FFT algorithm (Proakis: page 475, paragraph 6).

10. Claims 14-15 and 28-39 are rejected under 35 U.S.C. 103(a) as being unpatentable over Fielder in view of Proakis and further in view of Jhung (US 6304847 B1).

As per **claim 14** (depending on claim 10), even though Fielder teaches the tradeoff of using longer or shorter block length for a transform (column 3, lines 30-67), Fielder in view of Proakis does not expressly disclose "examining said first and second sequences of digital audio samples to determine a short or long transform length, and coding the audio samples using a short or long transform length as determined". However, this feature is well known in the art as evidenced by Jhung, who discloses that the Dolly AC-3 standard utilizes long transform or two short transform based on the transition condition (column 3, line 62 to column 4, line 24). Therefore, it would have been obvious to one of ordinary skill in the art at time the invention was made to modify Fielder in view of Proakis by specifically providing long transform or two short transform based on the transition condition, as taught by Jhung, for the purpose of handling different transition situations (Proakis: column 3, line 63 to column 4, line 2).

As per **claim 15** (depending on claim 10), Fielder teaches the tradeoff of using longer or shorter block length for a transform (column 3, lines 30-67) and "pairing the channels according to their determined transform length, and coding the audio samples of first and second channels in each pair according to determined transform length", (column 17, lines 3-25, 'two-channel system', processing a signal sample block (necessarily including a determined transform length) from each of the two channels: a DCT block...and A DST block', 'the coded (coding) block for given channel alternate (pairing) between the DCT and DST', 'a pair of blocks, one for each channel, are quantized and formatted (coding)'). But, Fielder in view of Proakis does not expressly disclose "determining a transform length for each of the channels". However, this feature is well known in the art as evidenced by Jhung, who discloses that the Dolly AC-3 standard utilizes long transform or two short transform based on the transition condition (determining transform length) (column 3, line 62 to column 4, line 24). Therefore, it would have been obvious to one of ordinary skill in the art at time the invention was made to modify Fielder in view of Proakis by specifically providing a long transform or two short transform based on the transition condition (determining transform length) as taught by Jhung, for the purpose of handling different transition situations (Proakis: column 3, line 63 to column 4, line 2).

As per **claims 28-39**, they recite an apparatus for coding input audio samples. The rejection is based on the same reason described for claims 1-2, 18, 3-5, 22-23, 14, 10 and 38-39 respectively, because claims 28-39 recite same or similar limitation(s) as claims 1-2, 18, 3-5, 22-23, 14, 10 and 38-39 respectively.

Conclusion

11. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a). A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

12. Any response to this action should be mailed to:
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Any inquiry concerning this communication or earlier communications from the examiner should be directed to Qi Han whose telephone numbers is (703) 305-5631. The examiner can normally be reached on Monday through Thursday from 9:00 a.m. to 7:00 p.m. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Richemond Dorvil, can be reached on (703) 305-6954.

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QH/qh
December 3, 2004

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